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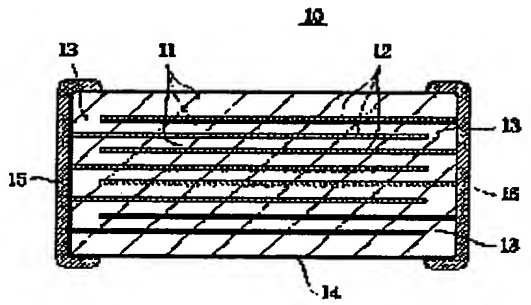
(54) LAMINATED CERAMIC CAPACITOR AND MANUFACTURE THEREOF

(57)Abstract:
PURPOSE: To enable a laminated ceramic capacitor to be obtained without a high-temperature burning process and protected against delamination and voids.
CONSTITUTION: Ceramic dielectric layers 11 and inner electrodes 12 are alternately laminated into a bare chip 14, the ends of the inner electrodes 12 are alternately exposed at both the ends of the bare chip 14, and terminal electrodes 15 and 16 are provided to the ends of the bare chip 14 so as to have a continuity with the inner electrodes 12. The ceramic dielectric layer 11 is of layered clay mineral composed of clay mineral layers and dielectric polymer inserted between them, and the inner electrode 12 is also of layered clay mineral composed of clay mineral layers and conductive polymer inserted between them.



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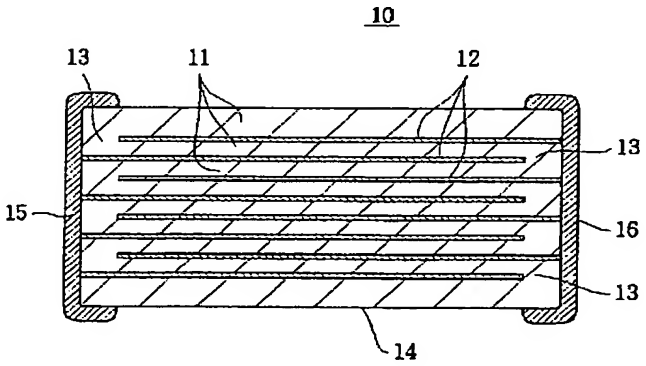
(54)【発明の名称】　積層セラミックコンデンサ及びその製造方法

(57)【要約】

【目的】　高温で焼成する必要がなく、デラミネーション及び空隙が生じにくい。

【構成】　セラミック誘電体層１１と内部電極１２が交互に積層して形成され、相対向するチップ両端部に内部電極１２が交互に現れたベアチップ１４と、このベアチップ１４の両端部に内部電極１２に導通するように焼付けられた一対の端子電極１５，１６を備える。セラミック誘電体層１１が粘土鉱物層間に誘電体ポリマを挿入した層状粘土鉱物であって、内部電極１２が粘土鉱物層間に導電性ポリマを挿入した層状粘土鉱物であることを特徴とする。



10　積層セラミックコンデンサ
11　セラミック誘電体層
12　内部電極
13　積層歪み調整用誘電体層
14　ベアチップ
15，16　端子電極

【特許請求の範囲】
【請求項１】　セラミック誘電体層(11)と内部電極(12)が交互に積層して形成され、相対向するチップ両端部に前記内部電極(12)が交互に現れたベアチップ(14)と、前記ベアチップ(14)の両端部に前記内部電極(12)に導通するように焼付けられた一対の端子電極(15,16)を備えた積層セラミックコンデンサ(10)において、
前記セラミック誘電体層(11)が粘土鉱物層間に誘電体ポリマを挿入した層状粘土鉱物であって、前記内部電極(12)が粘土鉱物層間に導電性ポリマを挿入した層状粘土鉱物であることを特徴とする積層セラミックコンデンサ。
【請求項２】　層状粘土鉱物がマイカ、モンモリロナイト、バイデライト、ヘクトライト、サポナイト、ノントロナイト又はクロライトである請求項１記載の積層セラミックコンデンサ。
【請求項３】　誘電体ポリマがポリエチレンオキシド、ポリアニリン、ポリピロール又はポリアセチレンのいずれかであって、導電性ポリマがポリエチレンオキシド、ポリアニリン、ポリピロール又はポリアセチレンのいずれかにＩ又はＣｕをドープしたポリマである請求項１記載の積層セラミックコンデンサ。
【請求項４】　(a) 層状粘土鉱物の粉末と誘電体ポリマと溶媒とを混合して第１懸濁液を調製する工程と、
(b) 前記層状粘土鉱物の粉末と導電性ポリマと溶媒とを混合して第２懸濁液を調製する工程と、
(c) 前記第１懸濁液をスクリーン印刷し乾燥してセラミック誘電体層(11)を形成する工程と、
(d) 前記セラミック誘電体層(11)の上に前記第２懸濁液をスクリーン印刷し乾燥して所定のパターンの内部電極(12)を形成する工程と、
(e) 前記内部電極(12)の上に前記(c)工程と同様にしてセラミック誘電体層(11)を形成する工程と、
(f) 前記(d)工程の内部電極(12)の形成と前記(e)工程のセラミック誘電体層(11)の形成とを交互に行って積層体(20)を形成する工程と、
(g) 前記積層体(20)を前記誘電体ポリマ及び導電性ポリマのガラス転移温度でプレスする工程と、
(h) 両端部に内部電極(12)が現れるように前記プレスした積層体(20)をチップ状に切断する工程と、
(i) 前記チップ(14)の両端部に一対の端子電極(15,16)を形成する工程とを含む積層セラミックコンデンサの製造方法。
【請求項５】　第１懸濁液及び第２懸濁液のいずれか又は双方に昇華性増粘剤が含まれる請求項４記載の積層セラミックコンデンサの製造方法。
【請求項６】　(a) 層状粘土鉱物の粉末と誘電体ポリマと溶媒とを混合して第１懸濁液を調製する工程と、
(b) 前記層状粘土鉱物の粉末と導電性ポリマと溶媒とを混合して第２懸濁液を調製する工程と、
(c) 前記第１懸濁液をベースフィルム上にシート成形し乾燥してフィルム付きセラミック誘電体層を形成する工程と、
(d) 前記フィルム付きセラミック誘電体層からベースフィルムを剥離してセラミック誘電体層の上に前記第２懸濁液をスクリーン印刷し乾燥して所定のパターンの内部電極を形成する工程と、
(e) 前記フィルム付きセラミック誘電体層をそのセラミック誘電体層を接着面として前記内部電極が形成されたセラミック誘電体層の上に前記フィルム付きセラミック誘電体層を重ね合わせる工程と、
(f) 前記(d)工程の内部電極の形成と前記(e)工程のセラミック誘電体層の形成とを交互に行って積層体を形成する工程と、
(g) 前記積層体を前記誘電体ポリマ及び導電性ポリマのガラス転移温度でプレスする工程と、
(h) 両端部に内部電極が現れるように前記プレスした積層体をチップ状に切断する工程と、
(i) 前記チップの両端部に一対の端子電極を形成する工程とを含む積層セラミックコンデンサの製造方法。
【請求項７】　第１懸濁液及び第２懸濁液のいずれか又は双方に昇華性増粘剤が含まれる請求項７記載の積層セラミックコンデンサの製造方法。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は、マイカ等の層状粘土鉱物を含むベアチップの両端部に端子電極が設けられた積層セラミックコンデンサ及びその製造方法に関するものである。
【０００２】
【従来の技術】近年、ラジオ、マイクロカセットレコーダ、電子チューナ、ビデオカメラ等の超小型化、薄型軽量電子機器の発展に伴い、回路素子として使用されるコンデンサの小型、大容量化が強く要求されるようになってきた。これらの要求を満足する部品として積層セラミックコンデンサが知られている。従来、積層セラミックコンデンサを製造するには、最初にＢａＴｉＯ3系又はＰｂ系の誘電体セラミック粉末、有機バインダ、可塑剤及び有機溶剤を混合して誘電体ペースト又は誘電体スラリーを調製する。湿式積層法では、この誘電体ペーストをスクリーン印刷法により台板上にセラミック誘電体層を積層し乾燥した後、この誘電体層の上に間隔をあけて導電性ペーストをスクリーン印刷し乾燥することにより内部電極を形成する。これを交互に繰返して複数回積層した後、積層した内部電極の単位で両端部に内部電極が現れるように積層体をチップ状に切断する。続いて得られたチップを脱バインダ処理した後、焼成してベアチップとし、最後にベアチップの両端部に導電性ペーストを塗布し焼付けて一対の端子電極を形成する。この積層セラミックコンデンサを乾式積層法で製造するには、上記誘電体スラリーをドクタブレード法等により成膜乾燥し

てセラミックグリーンシートを作り、このグリーンシートからなる誘電体層の上に湿式積層法と同様に内部電極を形成し、これを交互に繰返して複数回積層した後、湿式積層法と同様に積層体の切断、チップの脱バインダ処理、焼成を行い、端子電極を形成する。

【０００３】

【発明が解決しようとする課題】しかし、従来の積層セラミックコンデンサの製造方法では、約９００又は１０００℃～１４００℃で積層体を焼成して焼結体のベアチップを作る必要があり、デラミネーション及び空隙が起こり得る欠点があった。

【０００４】本発明の目的は、高温で焼成する必要がなく、デラミネーション及び空隙が生じにくい積層セラミックコンデンサ及びその製造方法を提供することにある。

【０００５】

【問題点を解決するための手段】図１に示すように、本発明はセラミック誘電体層１１と内部電極１２が交互に積層して形成され、相対向するチップ両端部に内部電極１２が交互に現れたベアチップ１４と、このベアチップ１４の両端部に内部電極１２に導通するように焼付けられた一対の端子電極１５，１６を備えた積層セラミックコンデンサ１０の改良である。その特徴ある構成は、セラミック誘電体層１１が粘土鉱物層間に誘電体ポリマを挿入した層状粘土鉱物であって、内部電極１２が粘土鉱物層間に導電性ポリマを挿入した層状粘土鉱物であることにある。

【０００６】層状粘土鉱物を例示すれば、マイカ、モンモリロナイト、バイデライト、ヘクトライト、サポナイト、ノントロナイト又はクロライトが挙げられる。また誘電体ポリマを例示すれば、ポリエチレンオキシド、ポリアニリン、ポリピロール又はポリアセチレンが挙げられる。更に導電性ポリマを例示すれば、ポリエチレンオキシド、ポリアニリン、ポリピロール又はポリアセチレンにＩ又はＣｕをドープしたポリマが挙げられる。誘電体ポリマ及び導電性ポリマは積層体を一体化するときのバインダとしての機能も有する。

【０００７】図１～図３に示すように、本発明の第１の製造方法は、(a) 層状粘土鉱物の粉末と誘電体ポリマと溶媒とを混合して第１懸濁液を調製する工程と、(b) 層状粘土鉱物の粉末と導電性ポリマと溶媒とを混合して第２懸濁液を調製する工程と、(c) この第１懸濁液をスクリーン印刷し乾燥してセラミック誘電体層１１を形成する工程と、(d) このセラミック誘電体層１１の上に第２懸濁液をスクリーン印刷し乾燥して所定のパターンの内部電極１２を形成する工程と、(e) 内部電極１２の上に前記(c)工程と同様にしてセラミック誘電体層１１を形成する工程と、(f) 前記(d)工程の内部電極１２の形成と前記(e)工程のセラミック誘電体層１１の形成とを交互に行って積層体２０を形成する工程と、(g) この積層体２０を誘電体ポリマ及び導電性ポリマのガラス転移温度でプレスする工程と、(h) 両端部に内部電極１２が現れるようにプレスした積層体２０をチップ状に切断する工程と、(h) このチップ１４の両端部に一対の端子電極１５，１６を形成する工程とを含む方法である。

【０００８】本発明の第２の製造方法は、(a) 層状粘土鉱物の粉末と誘電体ポリマと溶媒とを混合して第１懸濁液を調製する工程と、(b) 層状粘土鉱物の粉末と導電性ポリマと溶媒とを混合して第２懸濁液を調製する工程と、(c) この第１懸濁液をベースフィルム上にシート成形し乾燥してフィルム付きセラミック誘電体層を形成する工程と、(d) このフィルム付きセラミック誘電体層からベースフィルムを剥離してセラミック誘電体層の上に第２懸濁液をスクリーン印刷し乾燥して所定のパターンの内部電極を形成する工程と、(e) フィルム付きセラミック誘電体層をそのセラミック誘電体層を接着面として内部電極が形成されたセラミック誘電体層の上にフィルム付きセラミック誘電体層を重ね合わせる工程と、(f) 前記(d)工程の内部電極の形成と前記(e)工程のセラミック誘電体層の形成とを交互に行って積層体を形成する工程と、(g) この積層体を誘電体ポリマ及び導電性ポリマのガラス転移温度でプレスする工程と、(h) 両端部に内部電極が現れるようにプレスした積層体をチップ状に切断する工程と、(i) このチップの両端部に一対の端子電極を形成する工程とを含む方法である。

【０００９】第１の方法及び第２の方法とも、第１懸濁液及び第２懸濁液の溶媒は水に限らず、有機溶媒でもよい。また第１懸濁液及び第２懸濁液のいずれか又は双方に、塗布性を高めるために、樟脳のような昇華性増粘剤を含ませることが好ましい。

【００１０】

【作用】層状粘土鉱物の粉末と誘電体ポリマと溶媒とを混合することにより、誘電体ポリマが粘土鉱物の層間に導入され、また層状粘土鉱物の粉末と導電性ポリマと溶媒とを混合することにより、導電性ポリマが粘土鉱物の層間に導入され、それぞれ第１懸濁液及び第２懸濁液が調製される。これらの第１及び第２懸濁液でセラミック誘電体層及び内部電極を形成することにより焼成工程を要しないため、デラミネーション及び空隙を殆ど生じない。

【００１１】

【実施例】次に本発明の実施例を図面に基づいて詳しく説明する。

＜懸濁液の調製＞層状粘土鉱物としての天然珪酸塩であるモンモリロナイトの水懸濁液にポリエチレンオキシド溶液を混合して第１懸濁液を調製する。ポリエチレンオキシドは結晶質であって６５℃で溶融する。モンモリロナイトの層間にポリエチレンオキシドが挿入（intercalate）された合成物は極めて良好に配列され、３１０℃で分解するまで溶融しない。ポリエチレンオキシドは良

好な誘電体ポリマであって、しかもヨウ素（Ｉ）をドープすることにより導電性ポリマとなる。この導電性ポリマ溶液を別のモンモリロナイトの水懸濁液に混合して第２懸濁液を調製する。第１及び第２懸濁液ともモンモリロナイトに対してポリエチレンオキシドを１０～２０重量%の割合で混合する。この例ではモンモリロナイトに１７．５重量%のポリエチレンオキシドがそれぞれインターカレートした。次の塗布性を増すために昇華性増粘剤の樟脳を微量添加混合した。

【００１２】＜積層体の形成＞第１懸濁液は図２に示す下カバー誘電体部２１のセラミック誘電体層１１、コンデンサ部２２のセラミック誘電体層１１、積層歪み調整用誘電体層１３及び上カバー誘電体部２３のセラミック誘電体層１１を形成するために用いられる。スクリーン印刷法によりアルマイト処理したアルミニウム板からなる剛体キャリヤ板２５の上に第１懸濁液を多数回塗布し乾燥して下カバー誘電体部２１を形成した後、下カバー誘電体部２１の上面に第２懸濁液を図３に示すように矩形の第１の印刷パターンで間隔をあけてスクリーン印刷し乾燥して複数の内部電極１２を形成した。これらの内部電極１２の間に第１懸濁液を第２の印刷パターンにより印刷乾燥して調整用誘電体層１３を形成した。第１の印刷パターンと第２の印刷パターンは写真フィルムのネガティブとポジティブの関係になる。次いでこの調整用誘電体層１３の上から第１懸濁液を塗布乾燥して下位のセラミック誘電体層１１と同一面積のセラミック誘電体層１１を形成した。このセラミック誘電体層１１と内部電極１２と調整用誘電体層１３の積層を繰返し行いコンデンサ部２２を形成した。次にコンデンサ部２２の上面に内部電極を印刷しないセラミック誘電体層１１のみを多数回積層して上カバー誘電体部２３を形成した。

【００１３】＜チップへの端子電極の形成＞下カバー誘電体部２１、コンデンサ部２２及び上カバー誘電体部２３の３つの部分からなる積層体２０を一体化するために、この積層体２０をキャリヤ板２５とともにナイロン製の可撓性袋（図示せず）で被包して真空パックすることにより、積層体に残存していた僅かなガス等を除去し、積層体内部を一層緻密化した。真空包装されたキャリヤ板付き積層体を静水圧プレス機（図示せず）によりプレスした。このときの作動流体であるシリコーン油の温度はポリエチレンオキシドのガラス転移温度である６５℃に保った。ポリエチレンオキシドがバインダとなって積層体を一体化した後、可撓性袋から取出し、この積層体を所定の大きさのチップ状に切断した。続いてこのチップをバレル研磨してその両端面に内部電極を露出させた。更にベアチップの両端にＡｇをスパッタリング法により蒸着させて、図１に示すように一対の端子電極１５，１６を形成した。

【００１４】なお、上記例では湿式積層法で積層セラミックコンデンサを製造したが、本発明はこの方法によらず、乾式積層法で製造してもよい。

【００１５】

【発明の効果】以上述べたように、従来の湿式及び乾式積層法のいずれの方法で積層セラミックコンデンサを作る場合も、約９００又は１０００℃～１４００℃で積層体を焼成して焼結体のベアチップを作る必要があったものが、本発明によれば焼成工程を要しないため、デラミネーション及び空隙を殆ど生じず、熱エネルギーを節約できる。

【図面の簡単な説明】

【図１】本発明の積層セラミックコンデンサの断面図。

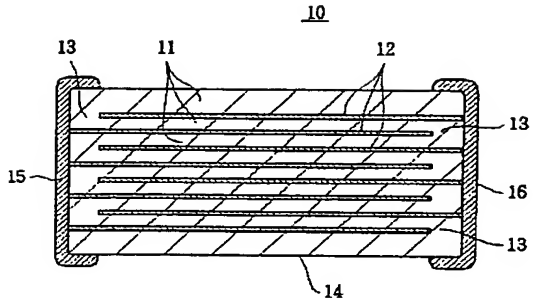
【図２】本発明の積層セラミックコンデンサのセラミック誘電体層及び内部電極を積層する状況を示す構成図。

【図３】その要部斜視図。

【符号の説明】

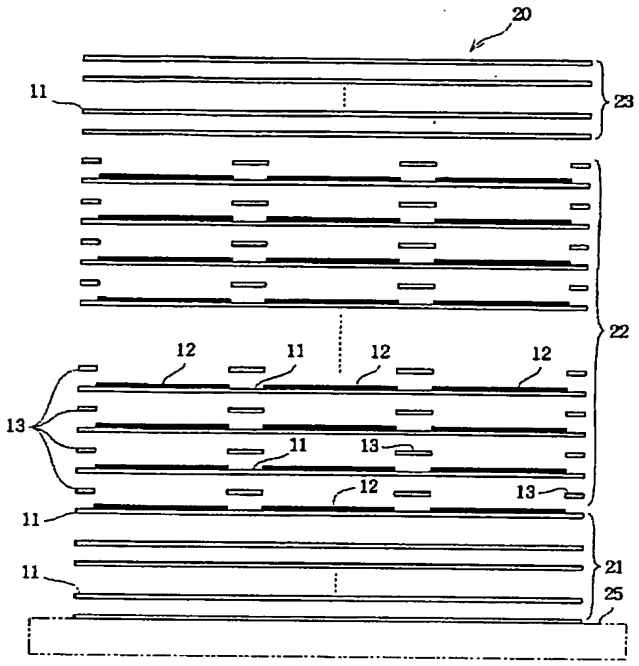
１０　積層セラミックコンデンサ
１１　セラミック誘電体層
１２　内部電極
１３　積層歪み調整用誘電体層
１４　ベアチップ
１５，１６　端子電極

【図１】

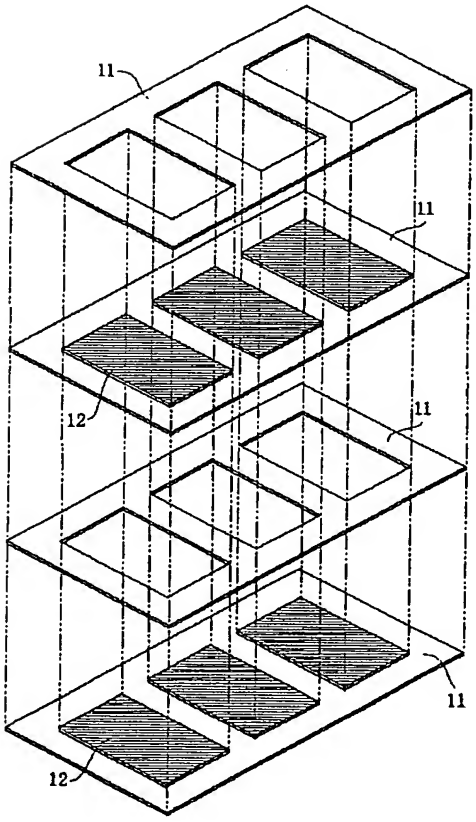


10　積層セラミックコンデンサ
11　セラミック誘電体層
12　内部電極
13　積層歪み調整用誘電体層
14　ベアチップ
15，16　端子電極

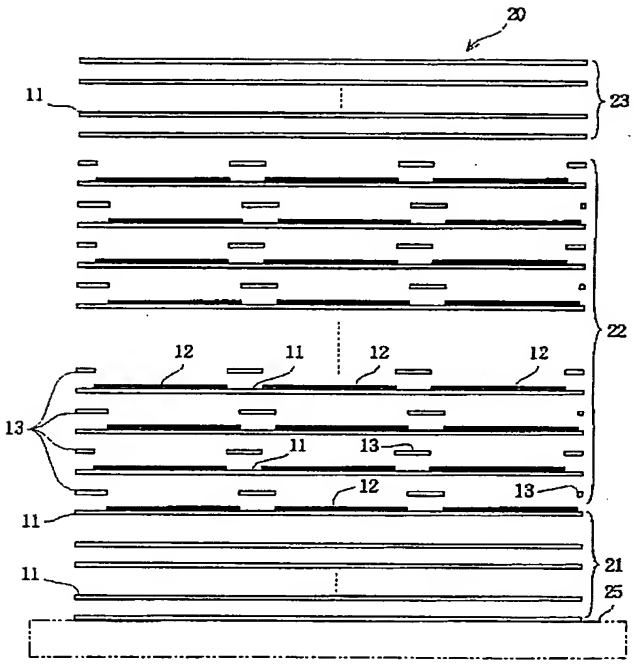
【図２】



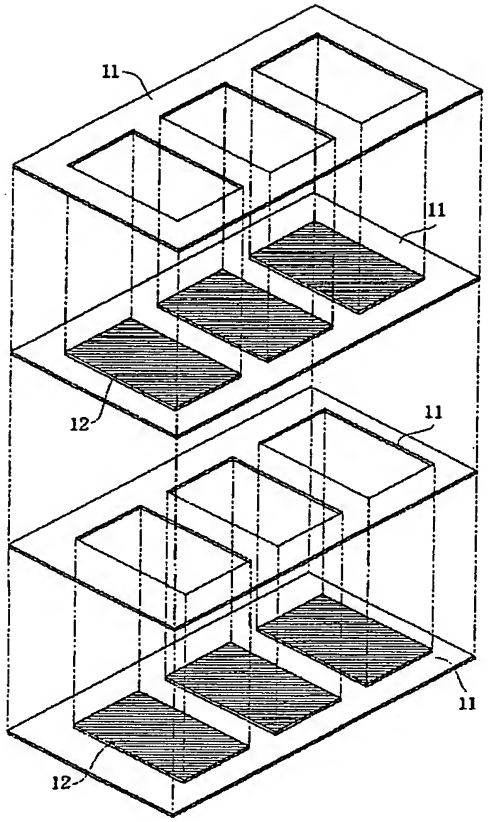
【図３】



【手続補正書】
【提出日】平成７年２月１３日
【手続補正１】
【補正対象書類名】図面
【補正対象項目名】図２
【補正方法】変更
【補正内容】
【図２】



【手続補正２】
【補正対象書類名】図面
【補正対象項目名】図３
【補正方法】変更
【補正内容】
【図３】



PATENT ABSTRACTS OF JAPAN

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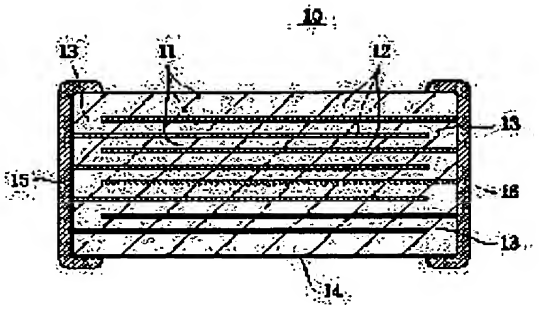
(72)Inventor : DAANARU PAAKAA BAAKUSU

(54) LAMINATED CERAMIC CAPACITOR AND MANUFACTURE THEREOF

(57)Abstract:
PURPOSE: To enable a laminated ceramic capacitor to be obtained without a high-temperature burning process and protected against delamination and voids.
CONSTITUTION: Ceramic dielectric layers 11 and inner electrodes 12 are alternately laminated into a bare chip 14, the ends of the inner electrodes 12 are alternately exposed at both the ends of the bare chip 14, and terminal electrodes 15 and 16 are provided to the ends of the bare chip 14 so as to have a continuity with the inner electrodes 12. The ceramic dielectric layer 11 is of layered clay mineral composed of clay mineral layers and dielectric polymer inserted between them, and the inner electrode 12 is also of layered clay mineral composed of clay mineral layers and conductive polymer inserted between them.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's

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CLAIMS

[Claim(s)]
[Claim 1] The bare chip with which the internal electrode (12) carried out the laminating to the ceramic dielectric layer (11) by turns, it was formed, and said internal electrode (12) appeared by turns in the chip both ends which carry out phase opposite (14), In the stacked type ceramic condenser (10) equipped with the terminal electrode (15 16) of the couple baked so that it might flow in said internal electrode (12) to the both ends of said bare chip (14) The stacked type ceramic condenser characterized by for said ceramic dielectric layer (11) being the stratified clay mineral which inserted the dielectric polymer between clay mineral layers, and being the stratified clay mineral with which said internal electrode (12) inserted the conductive polymer between clay mineral layers.
[Claim 2] The stacked type ceramic condenser according to claim 1 whose stratified clay mineral is a mica, a montmorillonite, beidellite, hectorite, saponite, nontronite, or a chlorite.
[Claim 3] The stacked type ceramic condenser according to claim 1 which a dielectric polymer is either polyethylene oxide, the poly aniline, polypyrrole or polyacethylene, and is the polymer to which the conductive polymer doped I or Cu to either polyethylene oxide, the poly aniline, polypyrrole or polyacethylene.
[Claim 4] (a) The process which mixes the powder, dielectric polymer, and solvent of a stratified clay mineral, and prepares the 1st suspension, (b) The process which mixes the powder, conductive polymer, and solvent of said stratified clay mineral, and prepares the 2nd suspension, (c) The process which screen-stencils said 1st suspension, dries and forms a ceramic dielectric layer (11), (d) The process which screen-stencils said 2nd suspension, dries and forms the internal electrode (12) of a predetermined pattern on said ceramic dielectric layer (11), (e) The process which forms a ceramic dielectric layer (11) like the aforementioned (c) process on said internal electrode (12), (f) The process which performs formation of the internal electrode (12) of the aforementioned (d) process, and formation of the ceramic dielectric layer (11) of the aforementioned (e) process by turns, and forms a layered product (20), (g) The process which presses said layered product (20) with the glass transition temperature of said dielectric polymer and a conductive polymer, (h) The process which cuts said pressed layered product (20) in the shape of a chip so that an internal electrode (12) may appear in both ends, and (i) The manufacture approach of a stacked type ceramic condenser including the process which forms the terminal electrode (15 16) of a couple in the both ends of said chip (14).
[Claim 5] The manufacture approach of a stacked type ceramic condenser according to claim 4 that a sublimability thickener is contained to either or the both sides of the 1st suspension and the 2nd suspension.
[Claim 6] (a) The process which mixes the powder, dielectric polymer, and solvent of a stratified clay mineral, and prepares the 1st suspension, (b) The process which mixes the powder, conductive polymer, and solvent of said stratified clay mineral, and prepares the 2nd suspension, (c) The process which carries out sheet forming of said 1st suspension on a base film, dries, and forms a ceramic dielectric layer with a film, (d) The process which exfoliates a base film from said ceramic dielectric layer with a film, screen-stencils said 2nd suspension, dries and forms the internal electrode of a predetermined pattern on a ceramic dielectric layer, (e) The process which piles up said ceramic dielectric layer with a film on the ceramic dielectric layer in which said internal electrode was formed [dielectric layer] in the ceramic dielectric layer, having used said ceramic dielectric layer with a film as the adhesion side, (f) The process which performs formation of the internal electrode of the aforementioned (d) process, and formation of the ceramic dielectric layer of the aforementioned (e) process by turns, and forms a layered product, (g) The process which presses said layered product with the glass transition temperature of said dielectric polymer and a conductive polymer, (h) The process which cuts said pressed layered product in the shape of a chip so that an internal

electrode may appear in both ends, and (i) The manufacture approach of a stacked type ceramic condenser including the process which forms the terminal electrode of a couple in the both ends of said chip.
[Claim 7] The manufacture approach of a stacked type ceramic condenser according to claim 7 that a sublimability thickener is contained to either or the both sides of the 1st suspension and the 2nd suspension.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the stacked type ceramic condenser with which the terminal electrode was prepared in the both ends of the bare chip containing stratified clay minerals, such as a mica, and its manufacture approach.
[0002]
[Description of the Prior Art] In recent years, small [of the capacitor used as a circuit element] and large capacity-ization have come to be strongly required with a microminiaturization of radio, a micro cassette recorder, an electronic tuner, a video camera, etc., and development of thin and light electronic equipment. The stacked type ceramic condenser is known as components with which are satisfied of these demands. In order to manufacture a stacked type ceramic condenser conventionally, the dielectric ceramic powder of BaTiO3 system or Pb system, an organic binder, a plasticizer, and an organic solvent are mixed first, and a dielectric paste or a dielectric slurry is prepared. By the wet-lay-up method, after carrying out the laminating of the ceramic dielectric layer on a base plate with screen printing and drying this dielectric paste, spacing is opened on this dielectric layer and an internal electrode is formed by screen-stenciling a conductive paste and drying. After it repeats this by turns and it carries out a multiple-times laminating, a layered product is cut in the shape of a chip so that an internal electrode may appear in both ends in the unit of the internal electrode which carried out the laminating. Then, after carrying out debinder processing of the obtained chip, it calcinates, and considers as a bare chip, finally a conductive paste is applied and baked on the both ends of a bare chip, and the terminal electrode of a couple is formed. In order to manufacture this stacked type ceramic condenser by the dry lay up method, membrane formation desiccation of the above-mentioned dielectric slurry is carried out by the doctor blade method etc., a ceramic green sheet is made, an internal electrode is formed like a wet-lay-up method on the dielectric layer which consists of this green sheet, cutting of a layered product, debinder processing of a chip, and baking are performed like [after it repeats this by turns and it carries out a multiple-times laminating] a wet-lay-up method, and a terminal electrode is formed.
[0003]
[Problem(s) to be Solved by the Invention] However, from the manufacture approach of the conventional stacked type ceramic condenser, the layered product needed to be calcinated at about 900 or 1000 degrees C - 1400 degrees C, the bare chip of a sintered compact needed to be made, and there was a fault from which delamination and an opening may happen by it.
[0004] It is not necessary to calcinate the object of this invention at an elevated temperature, and it is to offer the laminating ceramic condenser which delamination and an opening cannot produce easily, and its manufacture approach.
[0005]
[Means for Solving the Problem] As shown in drawing 1 , this invention is amelioration of the bare chip 14 with which the internal electrode 12 carried out the laminating to the ceramic dielectric layer 11 by turns, it was formed, and the internal electrode 12 appeared by turns in the chip both ends which carry out phase opposite, and the stacked type ceramic condenser 10 equipped with the terminal electrodes 15 and 16 of the couple baked so that it might flow in an internal electrode 12 to the both ends of this bare chip 14. It has the characteristic configuration that the ceramic dielectric layer 11 is the stratified clay mineral which inserted the dielectric polymer between clay mineral layers, and it is the stratified clay mineral with which the internal electrode 12 inserted the conductive polymer between clay mineral layers.
[0006] If a stratified clay mineral is illustrated, a mica, a montmorillonite, beidellite, hectorite, saponite,

nontronite, or a chlorite will be mentioned. Moreover, if a dielectric polymer is illustrated, polyethylene oxide, the poly aniline, polypyrrole, or polyacethylene will be mentioned. Furthermore, if a conductive polymer is illustrated, the polymer which doped I or Cu will be mentioned to polyethylene oxide, the poly aniline, polypyrrole, or polyacethylene. A dielectric polymer and a conductive polymer also have a function as a binder when unifying a layered product.

[0007] As shown in drawing 1 - drawing 3 , the 1st manufacture approach of this invention (a) The process which mixes the powder, dielectric polymer, and solvent of a stratified clay mineral, and prepares the 1st suspension, (b) The process which mixes the powder, conductive polymer, and solvent of a stratified clay mineral, and prepares the 2nd suspension, (c) The process which screen-stencils this 1st suspension, dries and forms the ceramic dielectric layer 11, (d) The process which screen-stencils the 2nd suspension, dries and forms the internal electrode 12 of a predetermined pattern on this ceramic dielectric layer 11, (e) The process which forms the ceramic dielectric layer 11 like the aforementioned (c) process on an internal electrode 12, (f) The process which performs formation of the internal electrode 12 of the aforementioned (d) process, and formation of the ceramic dielectric layer 11 of the aforementioned (e) process by turns, and forms a layered product 20, (g) The process which presses this layered product 20 with the glass transition temperature of a dielectric polymer and a conductive polymer, (h) The process which cuts the layered product 20 pressed so that an internal electrode 12 might appear in both ends in the shape of a chip, and (h) It is an approach including the process which forms the terminal electrodes 15 and 16 of a couple in the both ends of this chip 14.

[0008] The 2nd manufacture approach of this invention is (a). The process which mixes the powder, dielectric polymer, and solvent of a stratified clay mineral, and prepares the 1st suspension, (b) The process which mixes the powder, conductive polymer, and solvent of a stratified clay mineral, and prepares the 2nd suspension, (c) The process which carries out sheet forming of this 1st suspension on a base film, dries, and forms a ceramic dielectric layer with a film, (d) The process which exfoliates a base film from this ceramic dielectric layer with a film, screen-stencils the 2nd suspension, dries and forms the internal electrode of a predetermined pattern on a ceramic dielectric layer, (e) The process which piles up a ceramic dielectric layer with a film on the ceramic dielectric layer in which the internal electrode was formed [dielectric layer] in the ceramic dielectric layer, having used the ceramic dielectric layer with a film as the adhesion side, (f) The process which performs formation of the internal electrode of the aforementioned (d) process, and formation of the ceramic dielectric layer of the aforementioned (e) process by turns, and forms a layered product, (g) The process which presses this layered product with the glass transition temperature of a dielectric polymer and a conductive polymer, (h) The process which cuts the layered product pressed so that an internal electrode might appear in both ends in the shape of a chip, and (i) It is an approach including the process which forms the terminal electrode of a couple in the both ends of this chip.

[0009] Not only water but the organic solvent of the solvent of the 1st suspension and the 2nd suspension is sufficient as the 1st approach and 2nd approach. Moreover, in order to raise spreading nature to either or the both sides of the 1st suspension and the 2nd suspension, it is desirable to include a sublimability thickener like camphor.

[0010]

[Function] By mixing the powder, dielectric polymer, and solvent of a stratified clay mineral, by introducing a dielectric polymer between the layers of a clay mineral, and mixing the powder, conductive polymer, and solvent of a stratified clay mineral, a conductive polymer is introduced between the layers of a clay mineral, and the 1st suspension and the 2nd suspension are prepared, respectively. In order not to require a baking process by forming a ceramic dielectric layer and an internal electrode with such 1st and 2nd suspension, delamination and an opening are hardly produced.

[0011]

[Example] Next, the example of this invention is explained in detail based on a drawing.

A polyethylene oxide solution is mixed to the water suspension of the montmorillonite which is natural silicate as a <preparation of suspension> stratified clay mineral, and the 1st suspension is prepared. Polyethylene oxide is a crystalline substance and is fused at 65 degrees C. The compost by which polyethylene oxide was inserted between the layers of a montmorillonite (intercalate) is arranged very good, and it is not fused until it decomposes at 310 degrees C. Polyethylene oxide is a good dielectric polymer and serves as a conductive polymer by moreover doping iodine (I). This conductive polymer solution is mixed to the water suspension of another montmorillonite, and the 2nd suspension is prepared. The 1st and 2nd suspension mixes polyethylene oxide at 10 - 20% of the weight of a rate to a montmorillonite. In this example, 17.5% of the weight of polyethylene oxide intercalated in the montmorillonite, respectively. Since

the following spreading nature was increased, minute amount addition mixing of the camphor of a sublimability thickener was carried out.

[0012] The 1st suspension of <formation of a layered product> is used in order to form the ceramic dielectric layer 11 of the discharge-ring dielectric section 21 shown in drawing 2 , the ceramic dielectric layer 11 of the capacitor section 22, the dielectric layer 13 for laminating distortion adjustment, and the ceramic dielectric layer 11 of the arm-top-cover dielectric section 23. After having applied the 1st suspension many times, drying and forming the discharge-ring dielectric section 21 on the rigid-body carrier plate 25 which consists of an aluminum plate which carried out alumite processing with screen printing, by the 1st rectangular printing pattern, spacing was opened and screen-stenciled, the 2nd suspension was dried on the top face of the discharge-ring dielectric section 21, as shown in drawing 3 , and two or more internal electrodes 12 were formed in it. Among these, between the section electrodes 12, printing desiccation of the 1st suspension was carried out with the 2nd printing pattern, and the dielectric layer 13 for adjustment was formed. The 1st printing pattern and the 2nd printing pattern become the negative of a photographic film, and positive relation. Subsequently, spreading desiccation of the 1st suspension was carried out from on this dielectric layer 13 for adjustment, and the ceramic dielectric layer 11 of the same area as the low-ranking ceramic dielectric layer 11 was formed. The laminating of this ceramic dielectric layer 11 and internal electrode 12, and the dielectric layer 13 for adjustment was repeated, and the deed capacitor section 22 was formed. Next, the laminating only of the ceramic dielectric layer 11 which does not print an internal electrode was carried out to the top face of the capacitor section 22 many times, and the arm-top-cover dielectric section 23 was formed in it.

[0013] In order to unify the layered product 20 which consists of three parts, the <formation of terminal electrode to chip> discharge-ring dielectric section 21, the capacitor section 22, and the arm-top-cover dielectric section 23, by wrapping entirely and carrying out the vacuum packing of this layered product 20 with the flexible bag made of nylon (not shown) with the carrier plate 25, the slight gas which remained in the layered product was removed, and eburnation of the interior of a layered product was carried out further. The vacuum-packed layered product with a carrier plate was pressed with the hydrostatic-pressure press machine (not shown). The temperature of the silicon oil which is a working fluid at this time was kept at 65 degrees C which is the glass transition temperature of polyethylene oxide. After polyethylene oxide became a binder and unified the layered product, drawing and this layered product were cut from the flexible bag in the shape of [of predetermined magnitude] a chip. Then, barrel finishing of this chip was carried out, and the internal electrode was exposed to that ends side. Furthermore, the ends of a bare chip were made to vapor-deposit Ag by the sputtering method, and as shown in drawing 1 , the terminal electrodes 15 and 16 of a couple were formed.

[0014] In addition, although the laminating ceramic condenser was manufactured by the wet-lay-up method in the above-mentioned example, this invention may not be based on this approach, but may be manufactured by the dry lay up method.

[0015]

[Effect of the Invention] Since what needed to calcinate the layered product at about 900 or 1000 degrees C - 1400 degrees C, and needed to make the bare chip of a sintered compact does not require a baking process according to this invention also when making a laminating ceramic condenser by wet [conventional] and which approach of a dry lay up method as stated above, delamination and an opening are hardly produced but heat energy can be saved.

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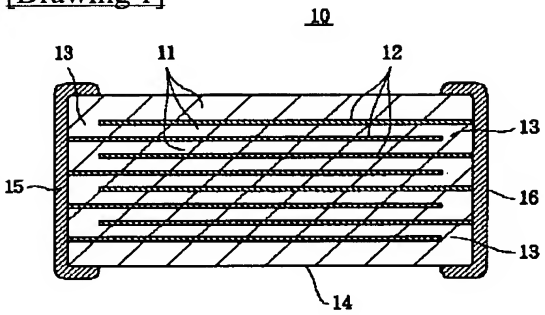
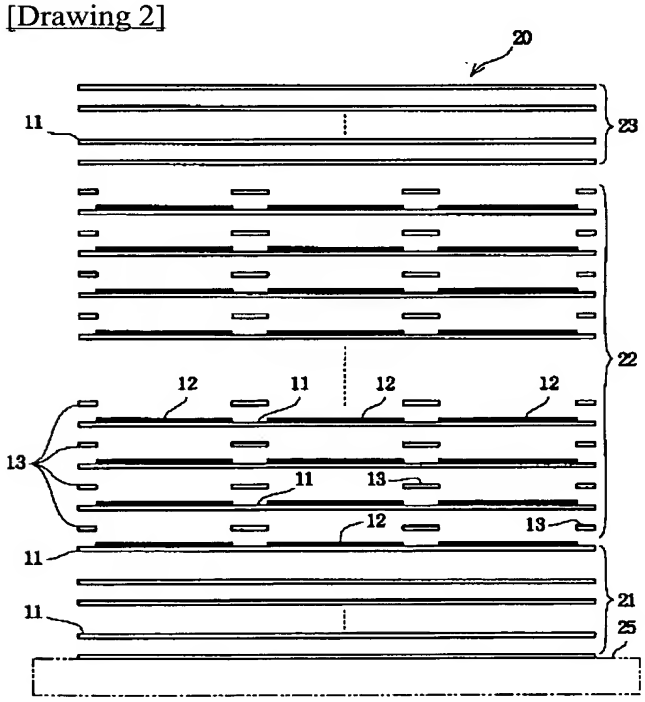
DRAWINGS

[Drawing 1]

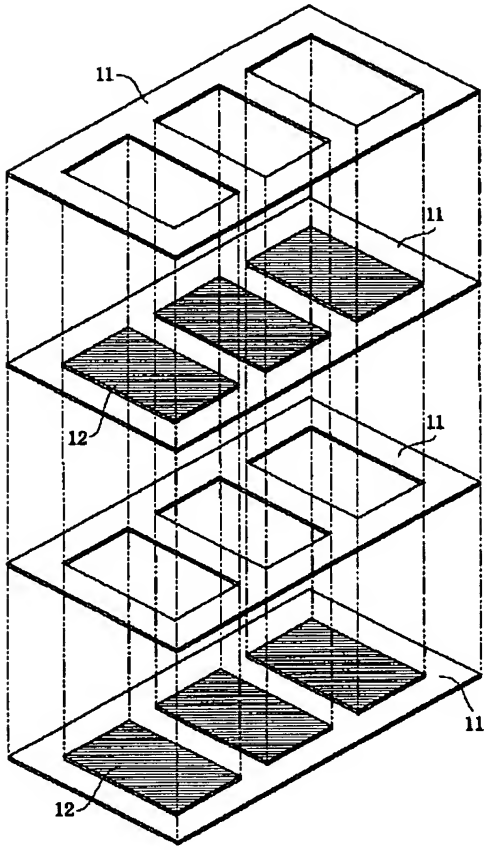


10 積層セラミックコンデンサ
11 セラミック誘電体層
12 内部電極
13 積層歪み調整用誘電体層
14 ベアチップ
15，16 端子電極

[Drawing 2]



[Drawing 3]



[Translation done.]